

THE ECOLOGY OF THE LAND-BIRDS OF TSAVO EAST
NATIONAL PARK, KENYA

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For the majority of land-bird species (indeed of all birds species) occurring in East Africa all that is known about their habitat preferences, seasonal occurrence and feeding ecology is what is contained in the various handbooks (e.g. Mackworth-Praed & Grant 1957, 1960), and annotated check-lists (e.g. Britton 1980). A few groups have received some more detailed attention: the birds of prey, by, for example Brown (1966) and Smeenk (1974), and the Palaearctic migrants by for example Pearson (1972), Britton (1974), Pearson & Backhurst (1976) and Sinclair (1978). However, for the migrants, only Britton (1974) did more than discuss the timing of movements. With a few notable exceptions the rest of Africa is in a similar situation.

The seasonal occurrence and habitat preferences of all bird species in Tsavo East National Park are mentioned very briefly by Lack, Leuthold & Smeenk (1980). The present paper serves to expand information on these features of the ecology of the land-birds, excluding the birds of prey, and provides the census figures on which the ecological interpretations are based. Where there are sufficient data, some information on feeding ecology is also given.

One of the central tenets of competition theory is Gause's competitive exclusion principle where "complete competitors cannot coexist" (Hardin 1960). Although there is currently considerable argument about the role of competition in structuring communities (e.g. Cody 1974, several authors in Keast & Morton 1980) it is a convenient way of pointing to important aspects of the ecology of the various species. Consequently, discussion in this paper will concentrate on differences between closely related species, with the species grouped usually into families.

STUDY AREA

Tsavo East National Park is an area of about 13 000 km² lying between about 80 and 150 km inland from the Kenya coast. It is divided into two parts by the Galana River. As with most previous work in the Park, the vast majority of the data for this study were collected in the part south of the river, and especially in the western half.

Climate

As in most parts of the tropics, Tsavo's seasons and climate are dominated by the rainfall. There are usually two wet seasons and two dry seasons each year. The so-called 'short' rains usually start during the first half of November and last through December. There is then the short dry season until late March, the 'long' rains during April, and from mid May to the end of October the long dry season. On average about half the annual total of rainfall falls in each wet season

(total varies from about 250 mm/yr at Aruba and to the east, to about 500 mm/yr on the west side near Voi) although in both years of this study, 1975 and 1976, the April rains were very poor. This feature may not be particularly unusual as, contrary to much of the rest of Kenya, the 'short' rains in the Tsavo area have been shown mathematically to be more reliable and predictable (Tyrell & Coe 1974).

The two dry seasons differ slightly in that during the long dry season the sky is more often overcast, the temperature is about 5°C cooler and there is a much stronger wind. In 1976 too this dry season was broken by a total of 50 - 100 mm of rain over a few days in early September. For more details of the temporal and spatial features of the climate see Cobb (1976), Leuthold (1977) or Lack (1980, 1983).

The habitats

A major scheme for classifying East African habitats was proposed by Pratt, Greenway & Gwynne (1966), and this was used in the present study as a basis for defining the habitats in Tsavo East. The Park falls into Pratt et al.'s ecological zone V which is characterized by a semi-arid climate with the "woody vegetation dominated by *Commiphora* and *Acacia* and allied genera often of shrubby habit" (Pratt et al. 1966, p. 371). Within this zone, Pratt et al. designated physiognomic types based on canopy cover of woody vegetation. The authors were mainly concerned with rangeland, and hence the amount of grass, and chose their critical values of canopy cover of woody vegetation at 2 per cent and 20 per cent. For birds the woody vegetation is a more important factor than grass, especially at low canopy cover. Critical values were chosen, therefore, at 1 per cent and 10 per cent canopy cover to define six main habitat types as follows: Grassland (G) less than 1 per cent trees, less than 1 per cent bushes; Bushed Grassland (BG) less than 1 per cent trees, 1 - 10 per cent bushes; Wooded and Bushed Grassland (WBG) 1 - 10 per cent trees, 1 - 10 per cent bushes; Bushland (B) less than 1 per cent trees, more than 10 per cent bushes; Wooded Bushland (WB) 1 - 10 per cent trees, more than 10 per cent bushes; Woodland (W) more than 10 per cent trees, variable, but usually more than 10 per cent bushes. A seventh habitat type was also defined - the small area of Riverine forest (R) along the Voi River extending to about 15 km east into the Park from Voi. The first five of these habitats (G, BG, WBG, B, WB) are referred to collectively as the Park savanna habitats (PSH).

When the Park was gazetted in 1948 the dominant vegetation type was Woodland (Napier Bax & Sheldrick 1963). This habitat is not now found in the southern area of the Park although it remains in areas just outside to the south and west near Voi and in parts of the northern area. The habitat type is dominated by *Commiphora* spp. (mainly *C. africana*) and *Acacia* spp. with a canopy at 7 - 8 m. The bush layer varies from very open to nearly impenetrable thickets, with *Grewia* spp. and *Sansevieria* spp. prominent. In the Park grasses are usually sparse or absent due partly to heavy grazing by wild mammals or, especially outside the Park, by domestic animals.

The most common habitats now inside the Park are Bushed Grassland and Wooded and Bushed Grassland. Together, these cover nearly three-quarters of the total area. The two thicker habitats, Bushland and Wooded Bushland, are mainly in the western part, and Grassland is rare. This radical change in habitat type over the last 35 years has been brought about particularly by fires and elephants. These changes have also resulted in changes in the species composition of the vegetation. *Commiphora* and *Acacia* are now almost absent and the main trees are *Melia volkensis*, *Delonix elata* and *Platycephium voense*. The bush layer is now dominated by *Premna* and *Sericocompsis*. With the opening up of the woody vegetation grasses of several species have greatly increased and are now a prominent feature of the habitat in many places.

The Riverine forest is rarely more than 150 m wide and has a nearly closed canopy at about 20 m, consisting especially of *Newtonia hildebrandtii*, *Dobera glabra*, *Ficus* spp. and *Acacia* spp. In most places there is a very dense bush layer. Grasses are very thick and matted around the edges, but sparse in the forest itself.

There are very few sources of permanent water in the Park. The main ones are the Athi, Tsavo and Galana Rivers, Aruba Dam, and some pools in the upper reaches of the Tiva River in the northern area. Minor sources include a few artificially enlarged waterholes near the Voi River, and a few pools in the tributaries of the Galana. This lack of water considerably restricts the distribution of most mammals in the dry season, and perhaps a few birds. In the wet season the situation changes drastically. Seasonal rivers start to flow, the most important being the Voi and the Tiva, and numerous shallow pans fill and hold water for varying periods; the majority of these pans are dry by a month after the last rain.

Food supplies and their seasonal variation

There were five main food types used by the land-birds in the Park: fruit, nectar, grass seeds, arthropods (mainly insects) and small vertebrates. The last of these was unimportant for any except birds of prey, which are not considered here in any detail.

The relative abundance of nectar, fruits, seeds and arthropods was measured through the year in 1976. How typical this year was is unknown in detail. The data for *Commiphora* woodland agree broadly with those given by Fenner (1983) for fruit and flowers, and the seasonal occurrence of the rain was as usual in 1976, although the amounts were below average.

Nectar was important only for the sunbirds Nectariniidae. In Woodland and Riverine, flowers of a variety of woody plants were visited, and there was no very obvious seasonal pattern in the occurrence of flowers. In the Park Savanna Habitats only *Delonix elata* and *Platycephium voense* produced flowers that were visited at all regularly. *D. elata* produced flowers at the end of both wet seasons and *P. voense* only in late March just before the April rains.

Rather few fruits seemed to be important in the diet of birds and there were three main seasonal patterns:

1. *Grewia bicolor* in Woodland, and *Premna* spp. in the Park savanna habitats produced fruits in the later parts of both wet seasons.

2. Some *Commiphora* spp. fruits (in Woodland only) were available all the year but there was a major peak in the abundance from July to September. *Salvadora persica*, only occurring in or near Riverine, had fruited only in July and August with none available at other times.

3. *Ficus* spp. (in Riverine only) appeared to fruit at any season although it is not known whether or not there were always one or more trees in fruit.

Some other fruits were eaten by birds, particularly in Woodland. Some fruits were probably available there all the year although there were probably more of species other than *Commiphora* in the wet season. The major peak of fruit abundance in Woodland was certainly between July and September, due to the *Commiphora*.

Grass seeds on stems showed a major peak in abundance in January and February (the two months following the 'short' rains) with smaller peaks following the poor 'long' rains (June) and any unseasonal rain, e.g. some seeds appeared in mid to late October following the rain in September 1976. The abundance of seeds on the ground was not measured but the peaks are likely to have been slightly later. The only period when they would not be available is likely to have been the first month of each wet season, due to germination. The effect found by Thiollay (1971) of grass cover hiding seeds on the ground is not important in Tsavo as the grass cover is rarely very high, due both to a lower total rainfall and the high grazing pressure.

The seasonal abundance of arthropods will be described in more detail elsewhere (Lack & Cockerell in prep.). By using pitfall traps and sweep-netting, arthropod biomass on the ground and in the grass layer vegetation respectively were found to increase by a factor of five or six in the December wet season compared with the dry season. By March the abundance in both had declined to their October levels. There was another increase in response to the April rains, but in 1976 this peak was lower than the December one. In years with more rain in April it may be larger.

The abundance of arthropods in the woody vegetation was not measured. In a similar area of Senegal, Morel (1968) found factors of 17 and 60 in two years for the biomass in the wet season compared with the preceding dry season. He did not, however, assess arthropods in the bark, only those on the leaves, so the difference between wet and dry seasons is considerably exaggerated.

METHODS

Censuses

The most important data for this study were the numbers of birds in

the various habitats in the different seasons. For this censuses were conducted which gave a relative abundance figure based on the numbers seen per unit time. All censuses were in units of 15 min, and the habitats were censused approximately in the proportion that each occurred in the whole area. The study period was divided into 25 calendar months from December 1974 to December 1976 inclusive, and the length of time spent censusing in each habitat in each month is given in Table 1.

TABLE 1

Number of 15-min censuses carried out in each habitat in each month

Year/months	Habitat							Total
	G	BG	WBG	B	WB	W	R	
1974: December	9	15	34	5	19	21	13	116
1975: January	13	32	28	19	21	29	17	159
February	12	59	32	18	13	27	13	174
March	9	21	27	13	13	23	7	113
April	11	40	38	16	13	26	11	155
May	8	27	38	9	25	13	11	131
June	12	33	33	21	18	26	7	150
July	7	22	28	15	10	19	8	109
August	5	15	31	7	24	13	8	103
September	10	31	36	22	14	22	7	142
October	8	35	34	16	13	14	6	126
November	12	27	36	21	14	26	8	144
December	5	5	18	8	10	19	8	73
1976: January	7	20	17	12	8	26	8	98
February	4	12	12	6	8	13	7	62
March	2	22	38	10	23	27	7	129
April	6	29	12	13	29	30	7	126
May	9	19	24	10	8	17	12	99
June	2	17	26	10	6	12	6	79
July	4	20	21	13	28	34	10	130
August	4	18	24	3	7	10	6	72
September	2	22	12	4	4	15	6	65
October	3	14	34	7	7	18	6	89
November	4	23	30	6	10	17	7	97
December	0	4	18	1	1	18	7	49
Totals	168	582	681	285	346	515	213	2790

Key: G = Grassland, BG = Bushed Grassland, WBG = Wooded and Bushed Grassland, B = Bushland, WB = Wooded Bushland, W = Woodland, R = Riverine

In censuses all birds seen and identified were counted while those only seen flying over were recorded separately. In addition, a list of

species that were only heard was made. All censuses were conducted between sunrise and 11:00.

The 15-min units were walked to the following patterns:

1. All Park savanna habitats: censuses were carried out at 1- or 2-km intervals along Park roads with the first one of a series taken at the first change of the car's odometer after a fixed point, usually a road junction. For the census itself the path walked varied a little but was usually a complete semi-circle (i.e. including the diameter which was the road) of radius about 150 m. This gives the area sampled in the 15 min as approximately 8 ha.
2. Woodland: almost all censuses were carried out while walking along existing paths, dividing these into 15-min units.
3. Riverine: due to the nature of the habitat a variety of methods was used. Where possible, and not potentially too dangerous, the author walked along the edge of, or through, sections of the forest in units of 15 min. In several cases, however, the counts were made while standing more or less stationary at one point.

The biggest problem with all comparisons of censuses is that of bird conspicuousness. In this study potential difficulties come under three headings:

1. Comparing species: the most important comparisons are between closely related species. These are usually similar in such characteristics as behaviour, amount of noise, bright colours, and are hence conspicuous to a similar degree.
2. Comparing seasons: in Tsavo there are in effect two seasons - wet and dry. In the wet season the leaves make all habitats more difficult to see through. Hence caution has to be exercised when a bird is apparently more common in the dry season.
3. Comparing habitats: those habitats with more vegetation are more difficult to see through than more open ones. Hence only the figures for those birds apparently more common in the open habitats need concern us. As will be seen, many more species show an increase in the denser habitats, and for those predominantly in the open there is usually general evidence from the literature and from feeding habits that they do indeed prefer them.

No corrections have been made for differing conspicuousness, largely because any would be very arbitrary. Differences certainly exist and may affect the fine detail of some of the figures presented here, but they do not affect the gross differences or arguments to be presented.

Feeding behaviour

During censuses and at other times observations of birds seen feeding were recorded. Data collected included the type of food where it was possible to identify this from observations; whence and how the food was obtained; activity of the bird (perched, flying, etc.); position in the vegetation and/or position before and after the feeding move-

ment, amplified by recording the height of the vegetation and the height of the bird in it and the horizontal position of the bird in the vegetation - if the bird was feeding in the woody vegetation it was assigned to the edge (up to 0.2m into the vegetation), just inside (c. 0.2 - 1.0m in), or inside (more than 1m in) - these three categories correspond roughly with the terminal twigs, larger twigs, and branches (including the trunk) respectively. The feeding rate was also recorded for birds which fed by sitting and waiting on perches and then flying out, either to catch insects in the air or on the ground, and sometimes the feeding rate was determined by watching individual birds for up to 15min.

It was often difficult (and would sometimes be misleading) to count the number of individual food items eaten. When a bird was 'seen feeding' at a site it was scored five items. However, when calculating vertical and horizontal position in the vegetation, only one figure per bird was scored - for horizontal the predominate one, for vertical the mean.

THE LAND-BIRDS

Lack et al. (1980) have recorded 324 species of land-birds in Tsavo East. About half of these have been seen too rarely for any quantitative analyses and only the more common species are considered here in detail. A list of the others recorded is given at the end of each section. For brief details of the status and records of these, and the common species, see Lack et al. (1980). Data on relative abundance of birds in each habitat are given in Table 2 and for each month in Table 3. All bird nomenclature follows Britton (1980).

Ostrich Struthionidae

From an ecological viewpoint the Ostrich *Struthio camelus* can be classed as a large herbivorous mammal, and Cobb (1976) included it in his survey of these. Cobb found, from aerial surveys, that it was primarily an open country species although the race in Tsavo East, the Somali Ostrich *S. c. molybdophanes*, is tolerant of thicker scrub than the other race occurring in Kenya, *massaicus*. The Somali race is also thought to be more of a browser than other races (Mackworth-Praed & Grant 1957).

Gamebirds Phasianidae, Guineafowl Numididae

Two common *Francolinus* species, the Yellow-necked Spur-fowl *F. leucoscepus* and the Crested Francolin *F. sephaena*, were both present all the year although the Yellow-necked Spur-fowl was a little more obvious in the wet seasons, perhaps because it was more vocal then. Both species preferred the thicker habitats, with the Yellow-necked Spur-fowl primarily in Riverine and Wooded Bushland, and the Crested Francolin primarily in Woodland. The Helmeted Guineafowl *Numida meleagris* also occurred rarely in the thicker habitats, especially Woodland. The very few of all three species seen feeding fed entirely from the ground. Swank (1977) analysed stomach contents of all three in Mkomasi Reserve just to the south of Tsavo West, in Tanzania. He found all three to be primarily vegetarian although insects, especial-

ly termites, formed 25 - 30 per cent of the diet of the two *Franco-linus* and 10 per cent for the Helmeted Guineafowl.

The final common species of these two families, the Harlequin Quail *Coturnix delegorguei*, is totally different from the other three. It is much smaller and it occurred mainly in the open habitats although always where there was a high grass cover. Also, in contrast to the others, it is highly migratory. It was present in very large numbers in December and January when the grass cover was highest and a few were seen in October and November and between February and May. It is well-known as a migrant and apparently breeds opportunistically when conditions are favourable (Britton 1980). As far as is known it feeds almost entirely on grass seeds taken from the ground.

Other species recorded: Hildebrandt's Francolin *F. hildebrandti*, Kenya Crested Guineafowl *Guttera pucherani*, Vulturine Guineafowl *Acryllium vulturinum*.

Button Quails Turnicidae

The Quail Plover *Ortyxelos meiffreni* was probably much commoner than it appeared from censuses as the majority were only seen when flushed at very close range. It occurred in all Park savanna habitats though it was not seen in areas with a grass cover of less than about 25 per cent. It was not seen in Woodland and it is probably a species which has moved into the area with the opening up of the habitat (Lack 1975). As far as is known it eats grass seeds.

Other species recorded: Button Quail *Turnix sylvatica*.

Bustards Otididae

The only common species was the Buff-crested Bustard *Eupodotis ruficrista*. It was a common resident in all habitats except Grassland and Riverine. It was very secretive but called frequently. It was heard in 52 per cent of all 15-min censuses so was certainly commoner than sightings would suggest.

Other bustards recorded: Hartlaub's *E. hartlaubii*, White-bellied *E. senegalensis*, Heuglin's *Neotis heuglini*, Kori *Otis kori*.

Plovers Charadriidae, Thicknees Burhinidae, Coursers Glareolidae
This group of long-legged insectivorous ground-dwelling species have similar ecology so are treated together. All may be at least partially nocturnal, especially the Spotted Thicknee *Burhinus capensis* and Heuglin's Courser *Rhinoptilus cinctus*. These two species, like the Buff-crested Bustard, are very secretive by day and were usually seen only when flushed at close range from the base of a bush. They had similar habitat preferences to the Buff-crested Bustard. The Spotted Thicknee was probably not very common but it is likely that Heuglin's Courser was much commoner than it appeared from censuses. The two species presumably do not compete seriously with each other as the thicknee is nearly four times the size of the courser. The next commonest courser, Temminck's *Cursorius temminckii*, was very much an open country species. Although only rarely seen in censuses (several were seen at other times) it was seen much more often between May and Oc-

TABLE 2

The number of each species/10 h in each habitat

Species	Habitat								Total
	G	BG	WBG	B	WB	W	R	PSH	
Yellow-necked Spurfowl	-	1	-	1	3	x	2	1	1
Crested Francolin	-	-	x	2	2	4	1	1	1
Harlequin Quail	6	8	12	7	6	1	2	8	7
Helmeted Guineafowl	-	-	-	x	-	1	x	x	x
Quail Plover	1	x	x	1	x	-	-	x	x
Buff-crested Bustard	x	2	3	4	2	1	-	2	2
White-bellied Bustard	1	x	x	x	x	-	-	x	x
Black-headed Plover	-	4	5	6	4	x	1	4	3
Crowned Plover	3	5	1	1	-	-	-	2	2
Caspian Plover	3	1	x	-	-	-	-	1	x
Spotted Thicknee	-	x	x	1	-	-	-	x	x
Heuglin's Courser	-	1	1	1	x	x	-	1	1
Black-faced Sandgrouse	-	21	18	19	12	1	-	16	12
Chestnut-bellied Sandgrouse	1	2	-	-	-	-	-	1	x
Red-eyed Dove	-	-	-	-	x	6	9	x	2
Ring-necked Dove	3	9	17	11	17	15	22	13	14
Laughing Dove	15	16	21	16	21	12	39	19	19
Namaqua Dove	x	3	6	1	2	x	-	3	3
Emerald-spotted Wood Dove	-	-	x	1	1	6	6	x	2
Orange-bellied Parrot	-	x	x	1	6	12	4	1	4
White-bellied Go-away Bird	-	-	-	x	2	15	-	x	3
Great Spotted Cuckoo	-	-	x	-	x	x	-	x	x
Black and White Cuckoo	-	x	1	x	1	2	x	1	1
Eurasian/African Cuckoo	-	x	1	1	2	1	2	1	1
Didric Cuckoo	-	x	2	x	1	x	1	1	1
White-browed Coucal	-	-	1	x	1	x	6	x	1
Speckled Mousebird	-	x	x	1	-	1	8	x	1
Blue-naped Mousebird	-	1	5	4	6	10	27	4	6
Striped Kingfisher	x	1	4	x	1	1	6	2	2
Chestnut-bellied Kingfisher	-	x	x	-	x	x	28	x	2
Eurasian Bee-eater	-	-	-	-	1	x	1	x	x
Madagascar Bee-eater	x	x	x	x	x	3	2	x	1
White-throated Bee-eater	2	1	1	-	-	-	9	1	1
Little Bee-eater	-	x	1	1	1	x	9	1	1
Somali Bee-eater	-	1	1	1	2	-	-	1	1
Eurasian Roller	8	6	7	5	6	3	1	7	6
Lilac-breasted Roller	1	2	2	1	1	x	10	2	2
Rufous-crowned Roller	-	x	x	x	1	x	2	x	x
Broad-billed Roller	-	-	-	-	-	-	4	-	x
Hoopoe	-	x	1	1	3	5	1	1	2
Green Wood Hoopoe	-	-	1	-	1	1	9	1	1
Abyssinian Scimitar-bill	-	x	3	3	4	5	-	2	2
Grey Hornbill	x	1	2	x	x	3	7	1	2

Continued opposite

Table 2, continued

Species	G	BG	WBG	B	WB	W	R	PSH	Total
Red-billed Hornbill	-	2	7	4	10	16	14	5	8
Von der Decken's Hornbill	-	x	2	1	6	35	6	2	8
Yellow-billed Hornbill	-	x	x	1	1	13	1	x	3
Brown-breasted Barbet	-	-	-	-	-	-	8	-	1
Black-throated Barbet	-	-	-	-	x	13	-	x	2
Spotted-flanked Barbet	-	-	x	-	-	x	8	x	1
Red-fronted Tinkerbird	-	-	-	-	-	2	2	-	1
d'Arnaud's Barbet	-	x	1	8	9	10	x	3	4
Red and Yellow Barbet	-	1	3	2	3	1	2	2	2
Greater Honeyguide	-	-	x	x	x	1	x	x	x
Lesser Honeyguide	-	-	-	-	x	1	2	x	x
Nubian Woodpecker	x	1	1	1	3	3	4	1	2
Cardinal Woodpecker	-	x	2	1	2	4	1	1	2
Bearded Woodpecker	-	-	x	-	x	-	3	x	x
Chestnut-backed Sparrow L'k	68	32	-	x	-	-	-	15	11
Chestnut-headed Sparrow L'k	77	52	43	4	7	-	-	37	27
Singing Bush Lark	5	3	x	1	-	-	-	1	1
Red-winged Bush Lark	44	15	6	2	x	-	-	10	7
Pink-breasted Lark	15	55	46	58	40	9	-	47	36
Friedmann's Bush Lark	x	x	x	-	x	-	-	x	x
Drongo	1	3	14	10	16	26	16	10	13
Black-headed Oriole	-	x	x	-	1	5	9	x	2
Golden Oriole	-	x	1	-	1	3	7	x	1
Grey Tit	-	-	x	-	x	1	-	x	x
Scaly Chatterer	-	-	-	1	1	5	-	x	1
Rufous Chatterer	-	-	-	-	-	1	-	-	x
Black Cuckoo Shrike	-	-	x	-	x	1	2	x	x
Zanzibar Sombre Greenbul	-	-	-	-	-	3	2	-	1
Northern Brownbul	-	-	-	-	-	4	3	-	1
Common Bulbul	-	x	1	1	1	15	5	1	4
Rufous Bush Chat	x	6	5	6	8	6	4	6	5
White-browed Scrub Robin	-	x	x	5	6	4	-	2	2
Irania	-	-	x	-	x	2	x	x	1
Sprosser	-	-	-	x	-	1	1	x	x
Rock Thrush	2	3	5	4	2	2	-	4	3
Isabelline Wheatear*	{ 6	8	3	4	1	-	-	4	3
	{ 16	12	3	1	1	-	-	6	4
Northern Wheatear*	x	2	2	1	1	-	-	2	1
Pied Wheatear	1	1	2	1	2	x	-	1	1
Capped Wheatear	x	1	x	-	-	-	-	x	x
Bare-eyed Thrush	-	-	-	-	x	3	-	x	1
Marsh Warbler	-	x	2	1	1	3	5	1	2
Upcher's Warbler*	{ -	x	1	1	x	1	-	x	1
	{ 1	1	2	2	2	7	10	1	3
Olivaceous Warbler*	-	x	x	-	x	6	10	x	2

Continued overleaf

Table 2, continued

	G	BG	WBG	B	WB	W	R	PSH	Total
Willow Warbler	-	1	2	1	3	4	1	2	2
Garden Warbler	-	-	x	-	x	1	-	x	x
Whitethroat	1	2	5	4	8	7	1	4	4
Barred Warbler	-	1	2	1	2	2	2	1	1
Yellow-breasted Apalis	-	-	-	x	x	x	-	x	x
Grey Wren Warbler	-	x	x	3	3	3	1	1	2
Desert Cisticola	5	x	-	-	-	-	-	x	x
Ashy Cisticola	10	3	1	1	x	-	-	2	2
Tiny Cisticola	-	x	1	-	1	5	-	x	1
Yellow-vented Eremomela	-	-	x	-	-	1	-	x	x
Red-fronted Warbler	-	-	-	1	x	-	x	x	x
Northern Crombec	-	1	1	1	3	5	-	1	2
Grey Flycatcher	-	x	2	1	1	4	-	1	1
Spotted Flycatcher	-	x	5	1	3	14	38	2	7
Black-headed Batis	-	-	x	-	-	-	7	x	1
Chin-spot Batis	-	-	-	-	x	2	-	x	x
Pygmy Batis	-	-	1	x	1	1	-	x	x
Paradise Flycatcher	-	-	x	-	-	1	1	x	x
Pangani Longclaw	11	4	2	2	x	-	2	3	2
Golden Pipit	4	20	22	16	10	2	x	17	13
Black-backed Puffback	-	-	-	-	-	-	8	-	1
Slate-coloured Boubou	-	-	x	x	2	6	-	x	1
Grey-headed Bush Shrike	-	-	-	-	-	1	1	-	x
Brubru	-	x	2	x	2	1	-	1	1
Rosy-patched Shrike	x	4	3	4	2	1	-	3	2
Three-streaked Tchagra	x	1	1	3	3	3	x	1	2
Black-headed Tchagra	-	-	-	-	-	1	x	-	x
Long-tailed Fiscal	-	x	x	1	1	-	x	x	x
Taita Fiscal	18	24	11	10	3	-	-	14	10
Red-backed Shrike	x	2	2	4	5	2	4	3	3
Red-tailed Shrike	9	17	12	12	10	9	5	13	11
Lesser Grey Shrike	1	1	x	1	1	x	-	1	1
White-crowned Shrike	x	7	11	10	19	18	9	10	12
Helmet Shrike	-	x	1	1	8	22	1	2	5
Retz's Helmet Shrike	-	-	-	-	-	-	17	-	1
Violet-backed Starling	-	-	-	-	-	2	-	-	x
Wattled Starling	6	10	11	3	17	2	19	11	10
Blue-eared Glossy Starling	-	-	-	-	x	-	8	x	1
Rüppell's Long-tailed Glossy Starling	-	-	-	1	1	-	-	x	x
Red-winged Starling	-	-	-	-	-	2	-	-	x
Magpie Starling	-	-	3	-	-	-	1	1	1
Golden-breasted Starling	1	7	20	20	22	25	14	15	17
Fischer's Starling	x	5	22	3	16	7	3	12	10
Hildebrandt's Starling	-	2	x	-	-	x	-	1	1

Continued opposite

Table 2, continued

	G	BG	WBG	B	WB	W	R	PSH	Total
Shelley's Starling	-	x	1	x	2	x	-	1	1
Superb Starling	x	16	24	13	42	2	8	21	17
Red-billed Oxpecker	1	4	3	2	5	1	6	3	3
Collared Sunbird	-	-	-	-	-	-	3	-	x
Eastern Violet-backed Sun'b	-	-	x	1	x	2	-	x	1
Amethyst Sunbird	-	-	-	-	-	x	4	-	x
Little Purple-banded Sun'b	-	x	-	-	1	10	1	x	1
Hunter's Sunbird	-	2	3	5	11	13	8	4	6
Abyssinian White-eye	-	-	1	x	x	x	1	x	x
Red-billed Buffalo Weaver	-	14	40	19	26	15	18	24	22
White-headed Buffalo Weaver	1	11	14	15	19	9	2	13	11
Parrot-billed Sparrow	1	9	17	8	20	1	33	13	12
Yellow-spotted Petronia	4	10	18	14	21	10	11	14	13
White-browed Sparrow Weaver	-	1	1	x	1	-	2	1	1
Black-capped Social Weaver	-	-	-	9	-	-	-	1	1
Red-headed Weaver	-	-	x	-	x	1	2	x	x
Black-necked Weaver	-	-	-	-	x	3	-	x	1
Masked Weaver	-	x	x	2	x	2	x	x	1
Black-headed Weaver	-	x	x	-	2	-	1	1	x
Chestnut Weaver	-	4	x	x	x	9	-	1	3
Red-billed Quelea	46	80	144	11	88	19	594	90	115
White-winged Widowbird	-	-	1	-	-	-	6	x	1
Fire-fronted Bishop	-	4	4	12	6	4	8	5	5
Pin-tailed Whydah	-	-	-	-	-	-	2	-	x
Paradise Whydah	-	-	13	-	1	1	13	5	4
Green-winged Pytilia	-	1	1	2	3	1	1	1	1
Red-cheeked Cordon-bleu	-	-	x	-	x	x	10	x	1
Purple Grenadier	-	-	-	-	1	1	-	x	x
Crimson-rumped Waxbill	-	-	1	-	-	-	2	x	x
Grey-headed Silverbill	-	-	1	-	1	2	-	1	1
Cut-throat	8	8	27	2	8	-	1	14	10
Somali Golden-breasted Bunting	-	2	5	15	12	3	-	6	5
Yellow-rumped Seed-eater	-	-	-	-	-	1	x	-	x

Notes: Habitat abbreviations as in Table 1

x = less than 0.5 seen per 10h

* = not identified positively in the 1974/75 winter, and some individuals not identified positively in the 1975/76 winter but the figures are given to facilitate comparisons

Total = average of the figures for the eight different habitats.

tober (7 of 10 seen in censuses) than between November and April.

There are two large resident plovers, the Black-headed *Vanellus tectus* and the Crowned *V. coronatus*. As can be seen from the figures,

Continued on page 19

TABLE 3

The number of each species/10 h in each month

Species	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Yellow-necked Spurfowl (56)	1	2	x	-	x	1	2	x	1	1	1	1
Crested Francolin (97)	2	x	2	x	1	2	1	4	1	1	2	-
Harlequin Quail (459)	-	-	-	1	2	41	31	x	x	x	x	-
Helmeted Guineafowl (19)	-	-	-	-	-	x	x	-	x	-	x	x
Quail Plover (24)	x	x	1	x	x	-	x	x	x	1	x	x
Buff-crested Bustard (136)	2	1	3	1	2	1	1	3	1	5	1	2
White-bellied Bustard (14)	x	x	1	-	x	-	-	-	-	x	x	x
Black-headed Plover (232)	2	2	2	5	2	6	1	2	4	4	7	3
Crowned Plover (112)	1	2	2	1	2	-	2	4	1	2	2	1
Caspian Plover (27)	-	-	x	1	1	-	1	2	x	-	-	-
Spotted Thicknee (16)	-	1	-	x	x	-	-	-	-	x	x	-
Heuglin's Courser (44)	2	3	1	-	1	x	-	-	x	x	-	1
Chestnut-bellied Sandgrouse (27)	-	1	4	-	-	-	-	-	-	-	x	-
Black-faced Sandgrouse (859)	15	8	12	16	14	8	6	7	14	18	13	17
Red-eyed Dove (122)	x	1	2	1	1	4	2	1	1	3	2	2
Ring-necked Dove (955)	9	8	9	13	15	13	23	15	12	19	12	15
Laughing Dove (1318)	2	4	2	7	7	53	102	14	5	4	9	6
Namaqua Dove (177)	-	-	-	2	1	3	7	5	3	2	6	1
Emerald-spotted Wood Dove (117)	x	2	1	1	1	4	2	2	2	2	2	1
Orange-bellied Parrot (245)	5	2	2	3	3	4	2	3	5	5	4	5
White-bellied Go-away Bird (206)	3	2	3	4	2	1	3	3	4	3	5	4
Great Spotted Cuckoo (14)	-	-	-	-	x	2	1	-	-	-	-	-
Black and White Cuckoo (51)	-	-	-	-	x	6	1	-	-	1	-	-
Eurasian/African Cuckoo (64)	-	-	-	1	3	2	x	-	-	4	-	-
Didric Cuckoo (54)	-	-	-	1	x	3	3	x	x	1	x	-
White-browed Coucal (55)	-	-	-	x	x	3	3	1	x	1	1	-
Speckled Mousebird (63)	1	2	-	x	x	2	2	1	1	x	2	-
Blue-naped Mousebird (452)	6	11	3	8	8	10	3	2	7	5	6	11
Striped Kingfisher (128)	1	2	1	1	1	3	3	2	1	2	2	2
Chestnut-bellied Kingfisher (160)	x	x	x	-	1	8	5	4	2	3	1	x

Table 3, continued

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Eurasian Bee-eater (14)	-	-	-	-	x	x	2	-	-	-	-	-
Madagascar Bee-eater (65)	-	-	-	x	x	1	5	1	3	-	-	-
White-throated Bee-eater (91)	-	-	-	-	4	1	6	x	2	1	-	-
Little Bee-eater (96)	2	1	1	x	1	2	3	x	1	3	1	1
Somali Bee-eater (74)	1	1	1	1	1	1	1	1	2	1	1	2
Eurasian Roller (385)	-	-	-	1	7	18	17	9	8	2	-	-
Lilac-breasted Roller (147)	2	1	2	2	1	3	3	2	2	2	3	2
Rufous-crowned Roller (23)	x	-	-	x	x	-	-	x	x	x	2	1
Broad-billed Roller (19)	-	-	-	x	x	2	-	1	x	-	-	-
Hoopoe (108)	1	x	x	-	1	x	3	1	1	3	4	4
Green Wood Hoopoe (87)	2	3	2	1	x	2	2	1	1	x	2	1
Abyssinian Scimitar-bill (169)	3	2	2	2	3	1	2	3	2	4	2	2
Grey Hornbill (120)	2	1	x	2	2	2	2	2	1	2	2	1
Red-billed Hornbill (548)	6	5	6	6	9	8	12	7	10	10	9	5
Von der Decken's Hornbill (580)	13	8	14	7	4	7	8	5	9	8	10	9
Yellow-billed Hornbill (188)	5	3	1	2	1	2	3	2	6	3	2	2
Brown-breasted Barbet (42)	2	1	1	x	x	x	x	x	1	1	1	1
Black-throated Barbet (163)	2	4	3	1	1	3	3	3	2	2	1	3
Spotted-flanked Barbet (52)	2	-	x	1	1	2	1	1	x	-	2	-
Red-fronted Tinkerbird (35)	1	x	x	x	x	-	1	1	1	x	1	1
d'Arnaud's Barbet (288)	5	3	3	5	4	4	4	5	4	6	4	3
Red and Yellow Barbet (137)	3	3	2	2	x	1	1	5	2	2	2	1
Greater Honeyguide (13)	x	x	-	-	-	-	-	-	1	x	x	-
Lesser Honeyguide (18)	-	-	-	-	x	1	x	x	-	1	x	x
Nubian Woodpecker (133)	2	2	3	2	2	2	2	2	1	3	1	2
Cardinal Woodpecker (114)	2	2	1	1	2	2	2	2	1	2	2	1
Bearded Woodpecker (18)	x	1	1	x	x	x	x	x	x	x	x	-
Chestnut-backed Sparrow Lark (756)	-	-	-	-	-	-	1	5	75	-	26	21
Chestnut-headed Sparrow Lark (1903)	79	18	40	9	12	7	1	24	11	67	77	7
Singing Bush Lark (74)	x	-	x	1	x	2	4	2	1	1	1	-
Red-winged Bush Lark (512)	6	6	7	7	6	8	9	12	8	10	7	3

Table 3, continued

	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Pink-breasted Lark (2527)	32	34	49	51	47	23	23	38	37	52	29	30
Friedmann's Bush Lark (10)	-	-	-	-	-	1	-	1	-	-	-	-
Drongo (919)	13	13	16	14	14	12	13	11	10	15	14	16
Black-headed Oriole (129)	2	3	2	2	1	2	2	1	2	3	2	1
Golden Oriole (91)	-	-	-	2	1	4	1	3	3	2	-	-
Grey Tit (12)	1	-	-	-	-	-	x	x	1	-	-	-
Scaly Chatterer (74)	1	3	-	1	1	x	2	2	x	1	2	x
Rufous Chatterer (18)	-	-	-	1	1	-	1	-	-	x	-	-
Black Cuckoo Shrike (30)	x	-	-	x	-	1	x	2	x	1	1	-
Zanzibar Sombre Greenbul (49)	x	x	1	1	1	1	2	1	x	-	1	x
Northern Brownbul (65)	-	x	2	1	3	1	1	-	1	1	2	1
Common Bulbul (275)	3	4	5	5	4	5	3	2	3	4	5	5
Rufous Bush Chat (381)	-	-	-	-	11	17	11	11	9	3	-	-
White-browed Scrub Robin (146)	2	4	3	1	2	1	2	2	2	3	2	1
Irania (39)	-	-	-	-	x	2	x	x	2	1	-	-
Sprosser (22)	-	-	-	-	1	2	x	-	-	1	-	-
Rock Thrush (218)	-	-	-	1	7	7	9	5	5	1	-	-
Isabelline Wheatear (226)	-	-	-	1	12	13	14	17	13	1	-	-
Northern Wheatear (85)	x	-	1	5	4	5	4	1	-	1	x	-
Pied Wheatear (75)	-	-	-	1	3	2	2	2	1	x	-	-
Capped Wheatear (15)	x	-	-	-	-	-	-	x	-	x	2	x
Bare-eyed Thrush (48)	1	x	1	1	1	1	1	-	1	1	1	x
Marsh Warbler (109)	-	-	-	-	3	11	2	1	x	1	-	-
Upcher's Warbler (36)	-	-	-	-	-	x	2	4	5	3	-	-
Olivaceous Warbler (141)	-	-	-	x	2	13	11	14	7	5	-	-
Willow Warbler (134)	-	-	-	2	x	4	1	x	6	9	-	-
Garden Warbler (16)	-	-	-	-	x	1	x	x	1	1	-	-
Whitethroat (309)	-	-	-	-	5	28	8	2	1	7	-	-
Barred Warbler (96)	-	-	-	-	1	5	6	2	1	x	-	-
Yellow-breasted Apalis (9)	x	x	x	x	-	-	-	-	-	-	x	x
Grey Wren Warbler (106)	3	2	x	1	1	4	2	1	2	1	1	1

Table 3, continued

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Desert Cisticola (24)	x	-	-	-	-	x	1	1	x	x	x	-
Ashy Cisticola (105)	1	1	1	1	x	2	2	2	2	3	2	1
Tiny Cisticola (83)	1	1	x	x	1	1	2	2	1	2	1	2
Yellow-vented Eremomela (13)	x	x	1	-	x	-	-	x	x	-	-	x
Red-fronted Warbler (10)	x	x	x	-	x	-	-	-	-	-	-	1
Northern Crombec (122)	1	2	3	3	2	1	x	3	3	1	1	2
Grey Flycatcher (95)	2	3	1	2	1	x	1	2	1	1	1	2
Spotted Flycatcher (500)	-	-	-	2	17	18	12	13	14	6	-	-
Black-headed Batis (39)	x	1	-	-	x	2	1	1	x	x	1	x
Chin-spot Batis (32)	x	x	1	x	1	x	1	-	x	x	x	1
Fygy Batis (30)	1	1	1	1	-	-	-	x	1	-	-	1
Paradise Flycatcher (20)	-	-	-	-	-	1	1	1	1	x	x	-
Pangani Longclaw (165)	2	x	1	2	1	3	5	2	3	3	4	2
Golden Pipit (895)	x	1	1	3	20	39	22	26	22	13	x	1
Black-backed Puffback (45)	-	x	x	x	x	2	1	2	x	1	1	1
Slate-coloured Boubou (95)	2	2	1	1	1	2	1	1	3	x	2	1
Grey-headed Bush Shrike (18)	x	x	1	x	x	x	x	-	x	x	-	-
Brubru (67)	1	1	1	1	1	1	1	1	1	1	1	1
Rosy-patched Shrike (160)	1	1	1	5	2	2	2	4	2	3	2	3
Three-streaked Tchagra (111)	2	1	1	1	2	2	2	3	1	2	1	1
Long-tailed Fiscal (21)	-	1	-	x	-	x	x	-	-	1	1	-
Taita Fiscal (708)	8	8	15	11	11	6	8	14	12	11	11	10
Red-backed Shrike (184)	-	-	-	-	-	1	1	1	1	25	-	-
Red-tailed Shrike (802)	-	-	-	x	16	33	28	29	23	3	-	-
Lesser Grey Shrike (38)	-	-	-	-	-	-	-	-	-	6	-	-
White-crowned Shrike (819)	11	18	9	9	9	10	10	11	12	16	14	16
Helmet Shrike (382)	7	8	5	7	7	7	2	5	7	5	2	5
Retz's Helmet Shrike (89)	1	3	1	1	1	3	2	2	-	-	1	1
Violet-backed Starling (26)	-	-	-	-	-	-	-	-	1	-	2	1
Wattled Starling (667)	-	-	-	4	9	8	29	11	2	27	17	2
Blue-eared Glossy Starling (46)	-	2	1	1	1	2	1	-	-	-	1	x

Table 3, continued

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Rüppell's Long-tailed Glossy Starling (15)	1	x	-	-	-	-	-	-	-	x	1	-
Red-winged Starling (31)	-	4	2	-	-	-	-	-	-	-	-	-
Magpie Starling (61)	-	-	-	1	8	1	-	-	-	-	-	-
Golden-breasted Starling (1177)	20	29	25	15	15	12	15	17	16	15	15	16
Fischer's Starling (713)	8	20	6	14	5	9	7	5	22	6	7	19
Hildebrandt's Starling (35)	-	-	1	-	x	1	-	-	4	-	-	x
Shelley's Starling (44)	-	-	-	-	-	5	-	-	3	x	-	-
Superb Starling (1163)	20	21	15	15	10	10	14	11	22	24	26	15
Red-billed Oxpecker (228)	3	4	2	6	2	4	3	3	x	6	6	2
Collared Sunbird (17)	x	1	x	-	x	x	-	x	-	x	1	x
Eastern Violet-backed Sunbird (40)	2	x	2	1	x	1	-	x	x	1	x	x
Amethyst Sunbird (25)	1	2	x	x	-	x	x	-	x	x	x	x
Little Purple-banded Sunbird (148)	2	3	2	1	1	4	2	1	2	2	3	1
Hunter's Sunbird (421)	8	13	6	5	5	5	2	3	7	9	6	6
Abyssinian White-eye (24)	x	-	-	x	-	2	-	-	x	x	2	-
Red-billed Buffalo Weaver (1530)	12	10	5	12	33	22	30	15	43	22	46	11
White-headed Buffalo Weaver (799)	16	15	11	9	14	6	9	6	14	13	13	15
Parrot-billed Sparrow (836)	20	13	11	13	12	10	11	8	12	12	11	12
Yellow-spotted Petronia (937)	15	17	17	17	14	12	11	11	12	14	13	21
White-browed Sparrow Weaver (63)	4	-	x	x	x	-	1	1	1	1	x	x
Black-capped Social Weaver (63)	8	-	-	1	-	-	2	-	-	-	-	-
Red-headed Weaver (19)	x	-	-	1	-	1	x	x	-	x	-	x
Black-necked Weaver (39)	1	1	1	1	x	1	x	-	x	1	1	x
Masked Weaver (47)	2	-	x	-	1	2	x	1	x	1	-	-
Black-headed Weaver (32)	-	-	-	-	-	1	1	1	1	-	3	-
Chestnut Weaver (183)	-	-	-	3	x	18	2	-	6	2	-	-
Red-billed Quelea (8053)	x	5	x	9	41	73	800	134	98	98	32	-
White-winged Widowbird (39)	-	-	-	-	-	2	5	-	-	-	-	-
Fire-fronted Bishop (353)	-	-	-	x	6	13	15	4	x	6	15	-
Pin-tailed Whydah (11)	-	-	-	-	-	x	x	x	x	x	-	-
Paradise Whydah (312)	-	-	-	-	-	1	35	12	-	2	1	-

Table 3, continued

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Green-winged Pytilia (85)	3	3	1	1	1	1	1	1	1	1	2	1
Red-cheeked Cordon-bleu (59)	-	-	2	1	1	2	1	x	1	2	1	-
Purple Grenadier (21)	x	1	-	x	x	-	x	x	-	-	x	x
Crimson-rumped Waxbill (25)	-	-	-	-	3	1	-	-	x	-	-	-
Grey-headed Silverbill (56)	-	-	-	-	-	3	-	3	3	3	-	-
Cut-throat (702)	-	1	-	-	x	2	33	22	41	12	1	1
Somali Golden-breasted Bunting (353)	7	4	5	7	5	3	4	6	4	4	5	7
Yellow-rumped Seed-eater (17)	x	2	-	-	1	-	-	-	-	-	-	-

Note: conventions as in Table 2 (where applicable); the figure after each bird's name is the total number recorded on censuses

Continued from page 13

there was a clear habitat difference between the two, with the Black-headed commonest in the thicker Park savanna habitats and the Crowned in the more open. There was some overlap, and in the overlap the Crowned, subjectively, seemed to prefer areas with more grass. The final common species, the Palaearctic Caspian Plover *Charadrius asiaticus*, only half the size of the two resident plovers, was virtually confined to very open areas, especially those almost devoid of grass to the south and east of Aruba. It was seen between early September and early April, usually in small flocks. Most appeared to be on passage. That only few were seen in censuses is mainly a reflection of its restricted habitat preferences.

All these species were only seen feeding from the ground taking insects, and all seemed to favour bare ground.

Other species recorded: Senegal Plover *Vanellus lugubris*, Cream-coloured Courser *Cursorius cursor*, Two-banded Courser *Rhinoptilus africanus*, Violet-tipped Courser *R. chalcopaterus*, and ten plover species, one thick-knee and one pratincole, all of which are mainly waterside birds.

Sandgrouse Pteroclididae, Pigeons Columbidae

There is some argument about the taxonomic relationships of these two families but as their ecological requirements are similar, they are considered together.

The six common species fall into three pairs based on body size. Of the large pair the Black-faced Sandgrouse *Pterocles decoratus* was very common throughout the year in all Park savanna habitats where there was

woody vegetation. It was very rare in Woodland and Riverine. Despite its need to drink every day its distribution in the southern part of Tsavo East did not seem to be restricted in the dry season. Sandgrouse are known to move quite long distances daily for water, e.g. *P. namaqua* goes up to 80 km each way in the Kalahari (McLean 1968). As far as is known, in common with other sandgrouse, the Black-faced is entirely granivorous throughout its life, taking small seeds from the ground.

The other large species, the Red-eyed Dove *Streptopelia semitorquata* was also a resident but had totally contrasting habitat preferences. It was common in Woodland and Riverine but was nearly absent from all Park savanna habitats. It seemed to be much more arboreal than any others in these families and, although there was only one record of it eating fruit in the present study - on the bush *Salvadora persica* - it is suspected that it was rather more of a frugivore than a granivore. All the handbooks say it is entirely granivorous although Goodwin (1967) adds "it does also eat berries in trees". It was, however, entirely a frugivore at Lamto, Ivory Coast (Thiollay 1971).

The pair of small doves, the Namaqua *Oena capensis* and Emerald-spotted Wood Dove *Turtur chalcospilos*, had similar habitat preferences to the Black-faced Sandgrouse and Red-eyed Dove respectively, and hence were very different from each other. The wood dove was more widespread in the Park savanna habitats than the Red-eyed Dove, perhaps because it feeds entirely on seeds on the ground, particularly among the litter. It was a resident. The Namaqua Dove is, as far as is known, entirely granivorous but was seasonal in its occurrence in the Park. It was absent in the long dry season, increased sharply in the 'short' rains, and then remained in steadily reducing numbers until about mid June. Where it goes between June and November is unknown. Britton (1980) and Curry-Lindahl (1981) say that only local movements occur but, in common with many other species, the movements appear to be much more regular and substantial.

The middle-sized pair, the Ring-necked Dove *Streptopelia capicola* and the Laughing Dove *S. senegalensis*, were both fairly common in all habitats although statistically their preferences were different ($\chi^2 = 63$, with df 6, $P < 0.001$). However, their patterns of seasonal occurrence were different. The Ring-necked Dove was common in all habitats throughout the year (Fig. 1) although there was a slight increase in numbers in the wet seasons, especially in January. The Laughing Dove, by contrast, was only present in small numbers for most of the year and these were almost all in Woodland or near water. In December and January very large numbers came in to all habitats (Fig. 1). These birds were coming into Tsavo to breed. Both species seemed to be entirely granivorous, taking seeds from the ground. In Botswana, Irving & Beesley (1976) found that, in grain crops, the Ring-necked fed mainly from the heads of the standing corn and the Laughing Dove fed mainly from the ground. This difference did not appear to hold in Tsavo.

The Laughing Dove is regarded as migratory in several other parts of

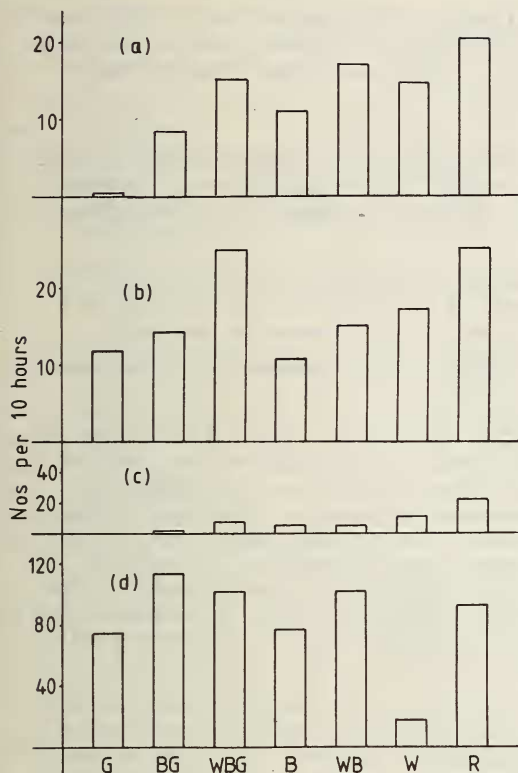


Fig. 1. The habitat preferences of two *Streptopelia* doves: a) Ring-necked *S. capicola* February to November, b) Ring-necked December and January, c) Laughing Dove *S. senegalensis* February to November, d) Laughing Dove December and January.

Habitat abbreviations as in Table 1.

Africa although it is often, as in Tsavo, partially resident. It occurs only after good rains in the Kalahari (McLean 1970). In Zambia largest numbers occur between April and November which is the dry season there, and there are evidently more birds after poor rains (Benson et al. 1973). This is, of course, the period they are absent from Tsavo, and although Benson et al. think that the influx to Zambia is from the south, they give little evidence to support this suggestion. The Tsavo birds might go to Zambia, but there is really too little documentation of the movements in other areas to be sure.

Other species recorded: Chestnut-bellied Sandgrouse *Pterocles exustus*, Speckled Pigeon *Columba guinea*, Mourning Dove *Streptopelia deceptiens*, Tambourine Dove *Turtur tympanistria* and Green Pigeon *Treron australis*.

Parrots Psittacidae

The Orange-bellied Parrot *Poicephalus rufiventris* was the only parrot species recorded in Tsavo East. It was fairly common, and resident, in Woodland and Riverine and a few were recorded in Wooded Bushland.

All parrots seen feeding (43 birds) were eating fruit except for one

eating leaves and one probably flowers. The species took fruit from both bushes (10 birds) and trees (33 birds) and took some of the large fruit, e.g. *Commiphora boiviniana* in addition to the commoner small *C. africana*, and others.

Turacos Musophagidae

The White-bellied Go-away Bird *Corythaixoides leucogaster* was a common resident in Woodland with a very few in Wooded Bushland and in trees along riverine fringes. It was, however, not seen in the Voi River forest.

As it is a shy bird very few feeding data were obtained, but it seemed to be largely a fruit eater (8 of 12 birds seen feeding, and 3 of the other 4 were eating *Acacia mellifera* flowers on one day).

Other species recorded: Violet-crested Turaco *Tauraco porphyreolophus*.

Cuckoos Cuculidae

None of the eleven species recorded was common, although only two can be considered rare, the Emerald Cuckoo *Chrysococcyx cupreus* and the Yellowbill *Ceuthmochares aereus*. Three others were seen only very rarely but were heard regularly in the wet seasons: the Black Cuckoo *Cuculus clamosus*, Red-chested Cuckoo *C. solitarius* and Klaas' Cuckoo *Chrysococcyx klaas*. All three were almost restricted to Woodland. The first two are probably migratory, being present from November to January and April. Only three Klaas' Cuckoos were seen in censuses, and one was in each of June and July, suggesting that it may be partially resident.

The only other species which can be seen all the year (despite the data in Table 3) is the White-browed Coucal *Centropus superciliosus*. It was, however, much commoner in the wet seasons. It occurred fairly commonly in thick bushes, especially along rivers and small water-courses, although it retreated to the main rivers in the dry season. All four food items seen taken were large insects from the ground.

The other species were all wet season visitors only. All occurred in both wet seasons although all were commoner in December and January than in April. The Great Spotted Cuckoo *Clamator glandarius* occurred wherever there were trees, especially in Wooded and Bushed Grassland. It has bred in Tsavo East (Trevor & Lack 1976) but whether the birds involved are all of Afrotropical provenance or include some which have bred in the Palaearctic is unknown. The Black and White Cuckoo *Clamator jacobinus* is a little smaller than the Great Spotted but was more common. It was usually seen low down in bushes (none of the 13 food items taken was higher than 1 m up in the vegetation) but it was nevertheless commoner in habitats with trees (WBG, WB, W and R) ($\chi^2=14$, with df 1, $P<0.01$). There is a breeding record of this species too (Turner 1977), which suggests that some at least are of African origin. However, East African birds are thought to be largely migrants from the Indian subcontinent (Friedmann 1964).

The one common small species, the Didric Cuckoo *Chrysococcyx caprius* was the commonest cuckoo of all. It occurred in all habitats

except Grassland but was commoner in those with trees ($\chi^2=18$, with df 1, $P<0.01$). Like the Black and White Cuckoo the Didric also apparently fed mainly in the bushes (6 of 7 birds seen feeding).

The final two species are often considered to be races of one and often they were not distinguished in this study: the African Cuckoo *Cuculus gularis* and the Eurasian Cuckoo *C. canorus*. Both occurred and the latter was probably the commoner. The two species combined were also commonest in habitats with trees, though both differ from other cuckoos in being seen in trees rather than bushes.

All sightings of food taken were of insects, mostly quite large ones.

Mousebirds Coliidae

The Blue-naped Mousebird *Urocolius macrourus* was a resident, although it was seen more often at times when *Commiphora africana* and *Salvadora persica* were fruiting (July to September and not the whole dry season). It was seen to eat fruits of both species extensively. It was commonest in Riverine but was more widespread than the Speckled Mousebird *Colius striatus* and occurred fairly commonly wherever there was woody vegetation. The Speckled Mousebird, also a resident, was almost confined to Riverine.

Both species were recorded only eating fruit, and both appeared to eat whichever was available at the time. The majority of sightings of both species were of birds in bushes, not trees (Blue-naped 67 of 78 birds and Speckled 11 of 15 birds). Despite the dominance of Riverine in their habitat preferences, neither was recorded eating *Ficus* spp. fruits.

Other species recorded: White-headed Mousebird *Colius leucocephalus*.

[to be continued]